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DISCUSSION OF ISSUES FOR IMPROVED PRODUCER-CONSUMER CO-OPERATION

Recycling of aluminium cans: environmental and economic aspects

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The attached paper is being made available to the Ad hoc Review Meeting on Bauxite, in the original language version.

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RECYCLING OF ALUMINIUM CANS ENVIRONMENTAL AND ECONOMIC ASPECTS

SUMMARY

Five years ago a recycling system for aluminium cans was introduced in Sweden. Svenska Returpack AB, a limited company, was founded and a special permit was issued by the Government to give the company the right to operate the recycling system. Last year the Swedish Government and Sweden's brewing industry decided to introduce a new refillable PET bottle in 1991. A recycling system for PET bottles has been tested 1988 on a small scale.

An investigation has been carried out into the energy consumption and environmental impacts of different packaging systems.

The paper will cover energy demand, environmental issues and economic questions. The recycling system for aluminium cans has achieved a high recycling rate of 83.3%. Swedish legislation and support from the Swedish Government are important factors in achieving this high reycling rate. A high deposit also produced a high return rate. A great many marketing activities have been carried out to improve environmental consciousness among consumers

INTRODUCTION

The packaging system used today in the Swedish brewery and soft drinks industry employs components and methods that have been successfully developed over a long period of time, to conform with requirements and demands as they arise. Some examples of the changes that have occurred and which have necessitated modifications to the system are:

A. Government demand for a packaging system to save energy and be environmentally friendly.

B. Consumer demand for a packaging system with non-breakable lightweight packaging.

C. The package should protect the product (soft drink or beer) from damage.

D. Working environment aspects should be an important consideration.

During the last ten years the various packaging systems have been through different development phases.

Resolution on recycling for aluminium cans

On May 18, 1982, Riksdagen (the Swedish Parliament) passed a bill on the recycling of aluminium cans under which at least 75% of all cans were to be recycled by 1985. One result was that a deposit was introduced for aluminium cans for beer and soft drinks.

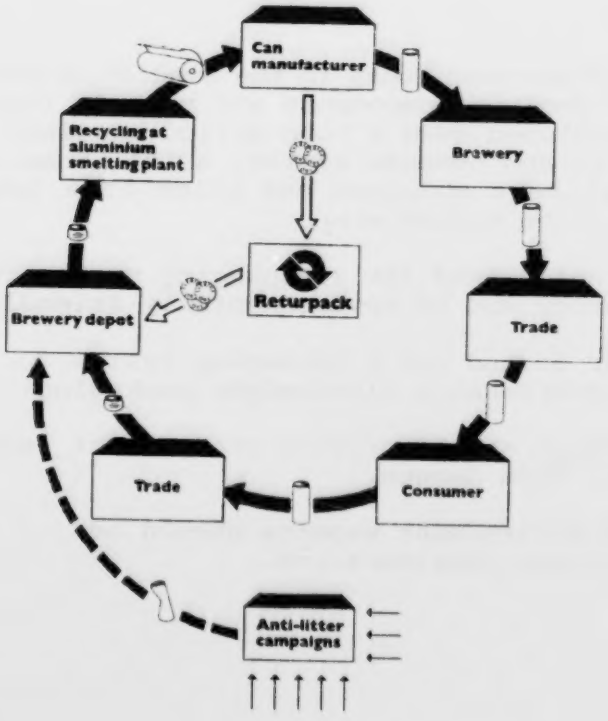
Responsibility for recycling

A special company, AB Svenska Returpack, is responsible for developing, coordinating and administrating the collection and deposit system. The recycling system is operated in compliance with special permission issued by the Government and based on an Act of Parliament. AB Svenska Returpack, which is jointly owned by the breweries, the retail trade and the packaging industry, has been granted this permission.

Recycling system for aluminium cans

A recycling system for aluminium cans was introduced in Sweden in 1984. The recycling rate has been raised over the last six years from 60% to the current figure of 83%. The recycling system for aluminium cans is described in Figure 1. All the cans collected by this system are used for the manufacture of new aluminium cans.

Fig. 1



The deposit system

The deposit system includes all aluminium cans for beer and soft drinks. The can manufacturer or drink importer charges a deposit on all returable cans which are delivered within the country and settles with Returpack. The deposit then follows the returnable can through each stage from the brewery and retailer to the consumer. The consumer gets the deposit back when the returnable cans are handed at a reception point, normally the retailer. The brewers collect the cans and take them back to the brewery, pay the deposit to the retailer and receive the corresponding sum from Returpack. The cans are then compacted, loaded and delivered to the aluminium smelting plant which then manufactures new can material from the scrap. Returpack receives payment for the UBC (used beverage containers). Returpack pays a handling fee to the breweries and retailers.

Contributing to "Keep Sweden Tidy"

The deposit system for aluminium cans generates resources for general environmental purposes. One Swedish öre from each can is allocated to measures for increased can recycling, anti-litter campaigns or other similar environmental purposes. If 850 million cans are sold a year in Sweden, the amount allocated for environmental purposes will be SEK 8.5 million annually Returpack and the National Swedish Environment Protection Board decide on how the money is to be used.

Refillable glass bottles

The refillable glass bottle system in Sweden has been improved by the introduction of a new crate. Weight has been cut by reducing the number of bottles in the crate from 24 to 20 bottles. At the same time, a study has been carried out with the aim of reducing the weight of the bottle from 300 to 250 grammas.

Recycling system for PET bottles

A recycling system for PET bottles has been tested on a small scale in 1988 using the same principle as that employed for cans.

Refillable PET-bottles

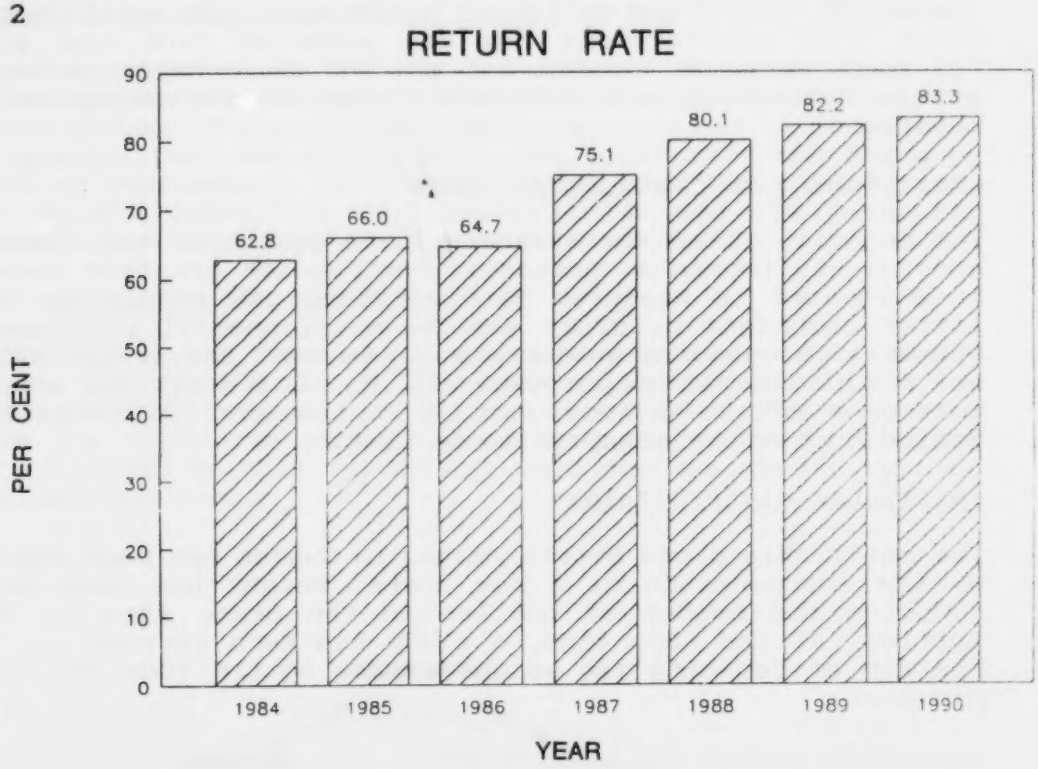
The brewing industry and the Swedish Government, have jointly decided to introduce a refillable PET bottle system in Sweden. The main reason for making this decision was a study carried out by Gustav Sundström of Miljöbalans AB which indicated that refillable PET bottles save energy and that the system is more environmentally-friendly than a recycling system for PET bottles.

3. RECYCLING RATE FOR ALUMINIUM CANS

When the system was introduced in Sweden the project group set the deposit at 25 öre per can.

But this deposit was insufficient achieve the 75% target set by the Government. On 17 March 1987 the Returpack Board and the Government jointly decided to increase the deposit to 50 öre per can. From 1987, the return rate has exceeded 75%, as shown in Figure 2.

Fig. 2



4. BACKGROUND TO THE HIGH RECYCLING RATE

There are many reasons why the Swedish can system is able to achieve a high return rate.

Ownership is very important if the recycling system is to be efficient and this is the main reason for retailer participation in the system.

The owners' of Returpack are the brewery industry, the packaging company (PLM) and the retailers.

All the cans are collected from retail outlets, either by means of reverse vending machines or manually in the case of the smaller shops.

The breweries collect the cans and control the number of cans and process them into flattered cans in the breweries.

Returpack is responsible for the transportation of the cans from the breweries to the smelting plant.

Returpack pays a handling fee of 11 öre per can to the retailer and 6.6 öre per can to the brewery.

Parliamentary legislation has been of great importance in supporting the recycling system. And support from the Swedish Government and the National Swedish Environment Protection Board has been an important factor in Returpack's efforts to achieve a high recycling rate.

In June 1990, the Swedish Government passed a new law requiring Returpack to achieve a 90% return rate by 1993.

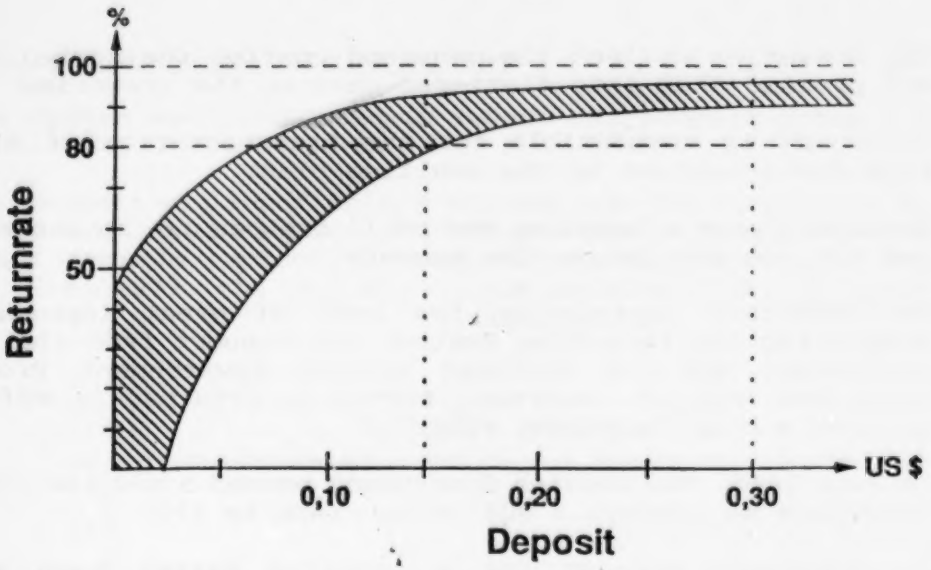
To guarantee success for a reycling system such as that operated by Returpack, it is essential to have the support of the Government and the "environmentalists". When the Returpack system was being introduced, the environmentalists containally opposed Returpack's goals, initially mainly due to litter problems and later because it was claimed that the system made excessive energy demands for the remelting of the cans. Several studies have been made concerning energy demand and, the environmental effects of aluminium can recycling system. We have finally been able to convince most environmentalists to accept the system after achieving a high recycling rate. But there still are some questions about destroying rainforest when mining bauxite. After studing this area Returpack are convinced of the awareness and the willness of the mining companies to protect the environment. We have also studied the Australian mining companies efforts to achieve new forest growths after

Returpack spent SEK 5 million per year in advertising to increase consumers' environmental consciousness . In the last two years, leading Swedish entertainment artiste and politicians have supported Returpack by participating in such campaigns. We consider that these campaigns were one of the most important reasons for achieving an 83.3% return rate in 1990.

The importance of a high deposit is shown in Figure 3. We think that it is impossible to achieve a high return rate without a deposit system. Different return systems have been tried in other countries:

- Voluntary return with delivery to special reception centres
- Sorting at source, with households using several different containers
- Deposit arrangements, with re-delivery through retailers or special reception centres

Fig. 3



Experience from voluntary arrangements, based on campaigns to motivate people to take empty containers to special reception centres, shows very low return levels. Without cash incentives or penalty schemes, it has not been possible to document return percentages in excess of 40%.

Sorting at source (curbside collection) is being tested in a number of different places around the world and is expected to make an important contribution to environmental and resource conservation. At the present time it is possible to draw a number of important conclusions with regard to the return percentage, which has been shown to vary greatly depending on:

- Housing type (detached houses compared to apartment blocks)
- Social status
- Motivation campaigns
- Penalties

The best results, with a return percentage of 60-70%, have been obtained in residential districts with detached houses occupied by higher social groups, supported by comprehensive motivation campaigns and fines for incorrectly sorted materials.

On the other hand, no system has been demostrated which functions in densely populated urban areas.

Furthermore, and perhaps most important, neither reception centres nor sorting at source will reduce visible pollution in the countryside, etc, which is largely the result of outdoor activities.

Experience indicates that, if a sufficiently high deposit is charged on empty containers, they will not be left lying in the country for long.

5. ENERGY DEMANDS OF DIFFERENT PACKAGING SYSTEMS

The calculation of energy demands for different packaging systems cover all steps from raw materials to waste processing and disposal. The calculation is done in steps so that it is possible to use a model to develop the system to achieve reduced energy demands and less environmental impact on the environment.

The result of the calculation for energy demands is shown in Figure 4.

Fig. 4 Existing packages

	Mj/l
33 cl white glass, 30 trips	2.9
33 cl green glass, 30 trips	3.3
100 cl glass, 10 trips	3.3
45 cl aluminium can, 82% return rate	3.3
150 cl PET one-way	4.9

After development work and the introduction of refillable PET bottles, almost all one-way packages will disappear from the Swedish market, and packaging in 1993 will mainly consist of the following systems (Figure 5). The energy demands for the different system are also shown.

Fig. 5 Packages under development

	Mj/l
150 cl PET, 10 trips	2.3
33 cl white, lighter returnable glass	2.8
45 cl aluminium can, 90% return rate	2.9
33 cl green, lighter returnable glass	3.2

If different packaging system are to be developed, it is important to take into consideration the energy demands for different steps in the system. Special attention has been given to energy demands, distribution, and the question of whether to use crates or cartons. Another important factor has been the energy demands for cleaning refillable bottles.

The energy demands for the different steps are shown in Figures 6, 7, 8, 9, 10, 11 and 12.

Fig. 6

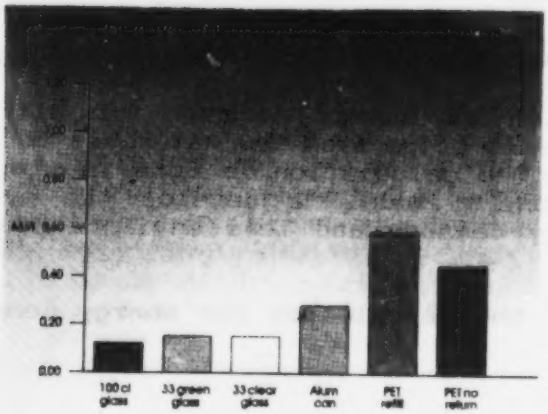


Fig. 7

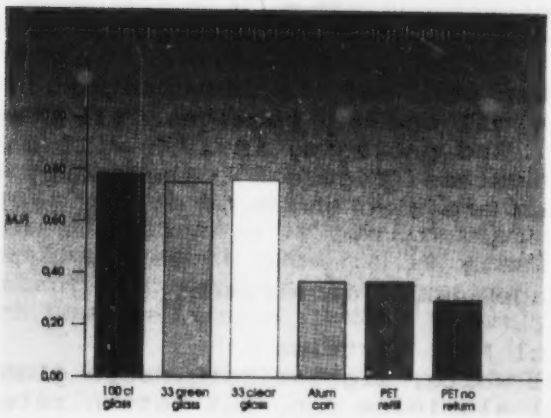


Fig. 8

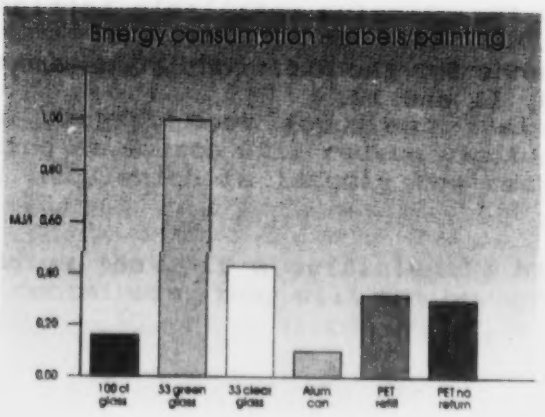


Fig. 9

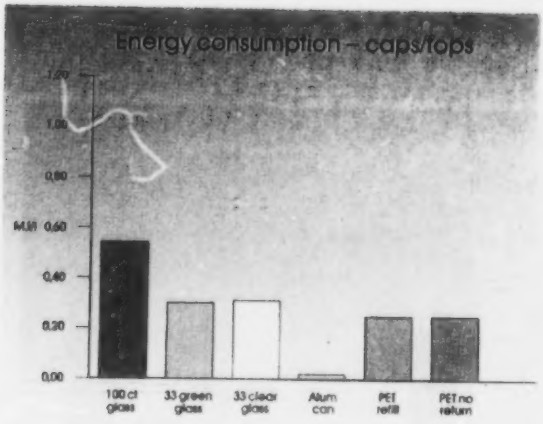


Fig. 10

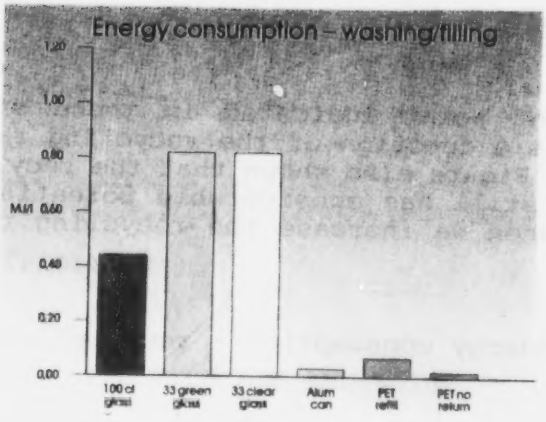


Fig. 11

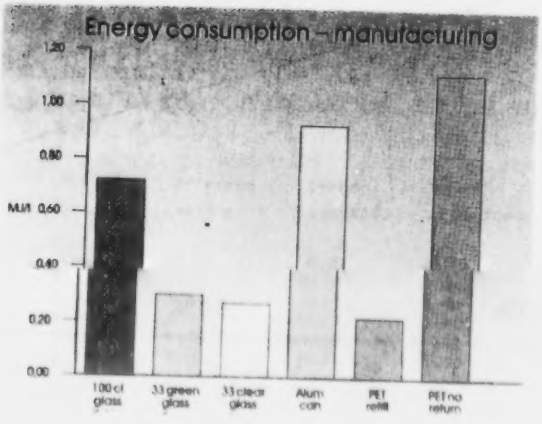
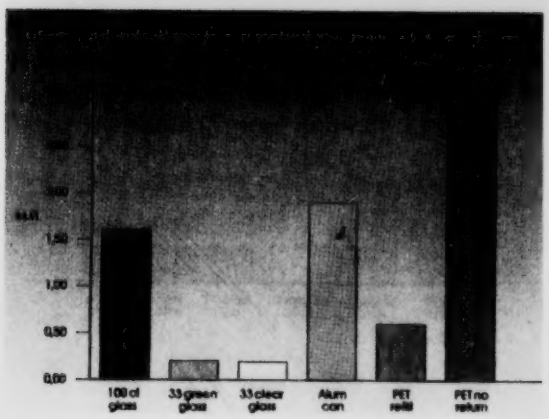
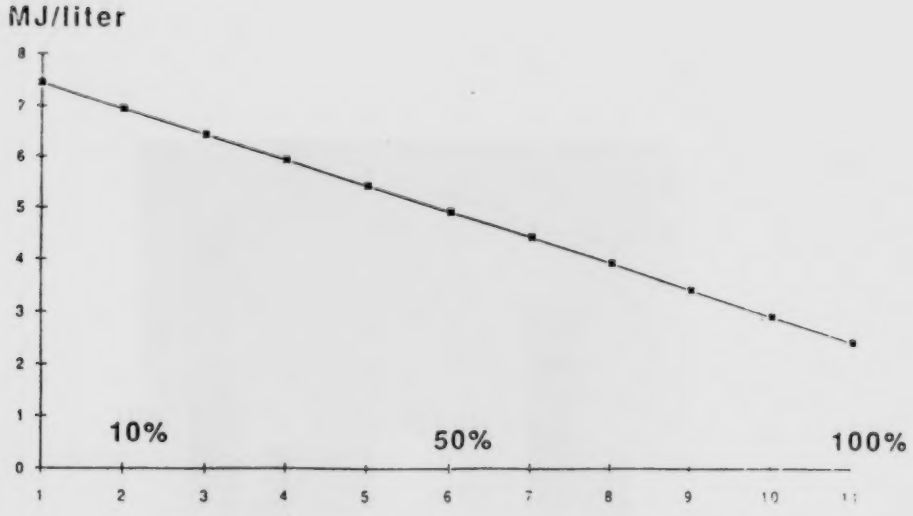


Fig. 12



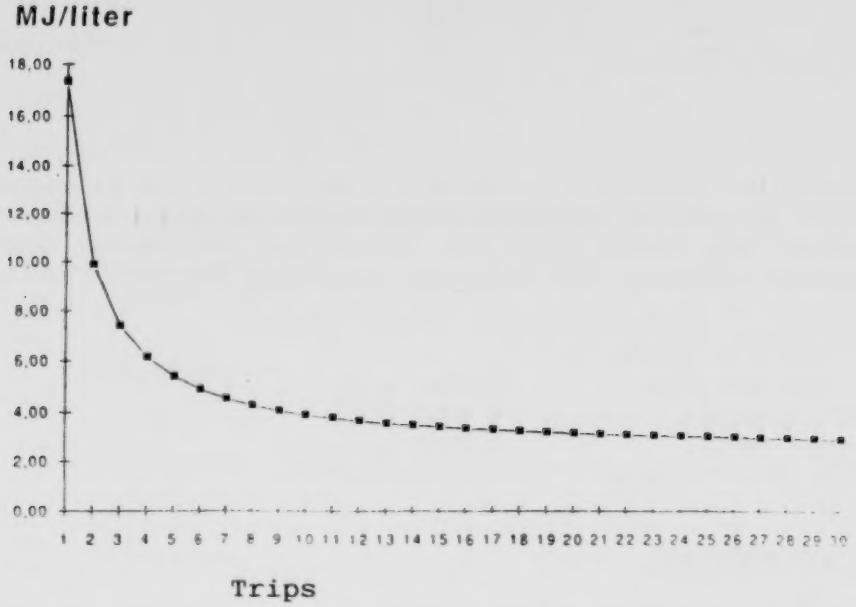
A very important point indicated in these studies is that energy demand is a function of the recycling rate as shown in Figure 13. This Figure also shows that the recyling system for aluminium cans still has considerable potential for reducing energy demand when we increase the recycling rate to 90% and even higher.

Fig. 13 Energy consumption - recycled can



For the refillable glass bottle we have already reached the limit as shown in Figure 14 and we cannot reduce energy demand by increasing the number of trips above 30 trips.

Fig. 14 Energy consumption - white refillable glass bottle



6. ENVIRONMENTAL EFFECT ON AIR AND WATER

All packaging systems will affect the environment in some way. For example the manufacture of cans and PET bottles has a higher impact on the environment than the manufacture of refillable glass bottles, but on the other hand the distribution of glass bottles has a higher environmental impact. The environmental impact on air and water is shown in Figures 15 and 16.

Fig. 15 Emissions into the air (grams/litre, number of trips and recycling rate)

	Dust	Sulphur oxides	Nitrogen oxides	Carbon monoxide	Hydro chlorides	Hydro carbons
33 cl w glass	0.13	1.21	1.32	0.32	0.01	0.24
33 cl g glass	0.14	1.73	1.32	0.29	0.01	0.22
100 cl glass	0.17	1.32	1.66	0.42	0.01	0.31
45 cl can	0.52	2.88	1.62	0.29	0.00	0.51
150 cl PET-o	0.16	2.11	1.68	0.30	0.01	0.23
150 cl PET-r	0.11	1.76	1.03	0.37	0.00	0.62

Fig. 16 Emissions into water (grams/litre, number of trips and recycling rate)

	Dissolved pollutants	Suspended materials	Biochemical oxygen consumption	Chemical oxygen consumption	Other metal ions	Hydro carbons
33 cl w glass		0.05	0.34	0.33	0.07	0.07
33 cl g glass		0.05	0.34	0.34	0.07	0.07
100 cl glass		0.05	0.34	0.33	0.07	0.07
45 cl can	0.03		0.02	0.40		
150 cl PET-o	0.37	0.08	0.23	0.57	0.02	
150 cl PET-r	0.07	0.09	0.24	0.60		

7. WASTE

Swedish households currently produce 2.6 million tons of waste per year. The breweries produce only 0.8% of this amount. Figure 18 shows how waste from the breweries is broken down interms of glass bottles, PET bpttles, caps and non-returnable cans.

Fig. 17

Glass-bottles	12,000 tons
PET-bottles	6,000 tons
Caps, metal	2,500 tons
Non return cans	2,000 tons

8. WORKING ENVIRONMENT

The most important factors related to brewery products are the lifting of heavy goods, noise, cuts from glass and the risk of explosions.

During the last few years, changes have taken place in the brewing industry distribution system. Shifting from manual order picking to mechanised order picking has reduced lifting work in distribution and in the order picking area. Changing over to materials such as aluminium and PET has reduced the risk of explosions and cuts. Light-weight packaging such as aluminium cans and PET bottles has also reduced heavy lifts in the retail shops.

9. ECONOMIC ASPECTS

As shown in Figure 18, the main revenue for Returpack AB is the deposit from not returned cans which are not returned and the revenue from the scrap obtained from used beverage containers.

The handling fees paid to retailers and breweries are the main costs for the system. Marketing costs are also a significant item in the budget for 1991.

The break even for the system occurs at a return rate of about 75%. Returpack charges 5 öre in administration costs for each can sold in Sweden to achieve a zero result for the year.

When a deposit system for beverage containers was introduced the industry was afraid of losing market shares. Experience from the Swedish deposit system for aluminium cans shows that the system has been a success and also that the cans have won increased market shares (Fig. 19).

Fig. 18

AB SVENSKA RETURPACK BUDGET 1991
SEK MILLION
IF 860 MILLION CANS SOLD
IF RETURN RATE 85 %

REVENUE		
DEPOSIT REVENUE	344.0	
ADMINISTRATIVE CHARGES	43.0	
IMPORT FEE	1.2	
SCRAP REVENUE	57.8	446.0
COST		
DEPOSIT EXPENSES	290.9	
HANDLING FEE RETAILERS	80.0	
HANDLING FEE BREWERIES	48.0	
STEEL CANS	2.2	
FREIGHT AND CONTAINER RENT	7.0	
MARKETING	9.2	
CONTRIBUTION TO "KEEP SWEDEN TIDY"	8.6	
ADMINISTRATION	6.4	452.3
FINANCIAL RESULT		-6.3
INTEREST NET		6.0
NET FINANCIAL RESULT FOR THE YEAR		0.0

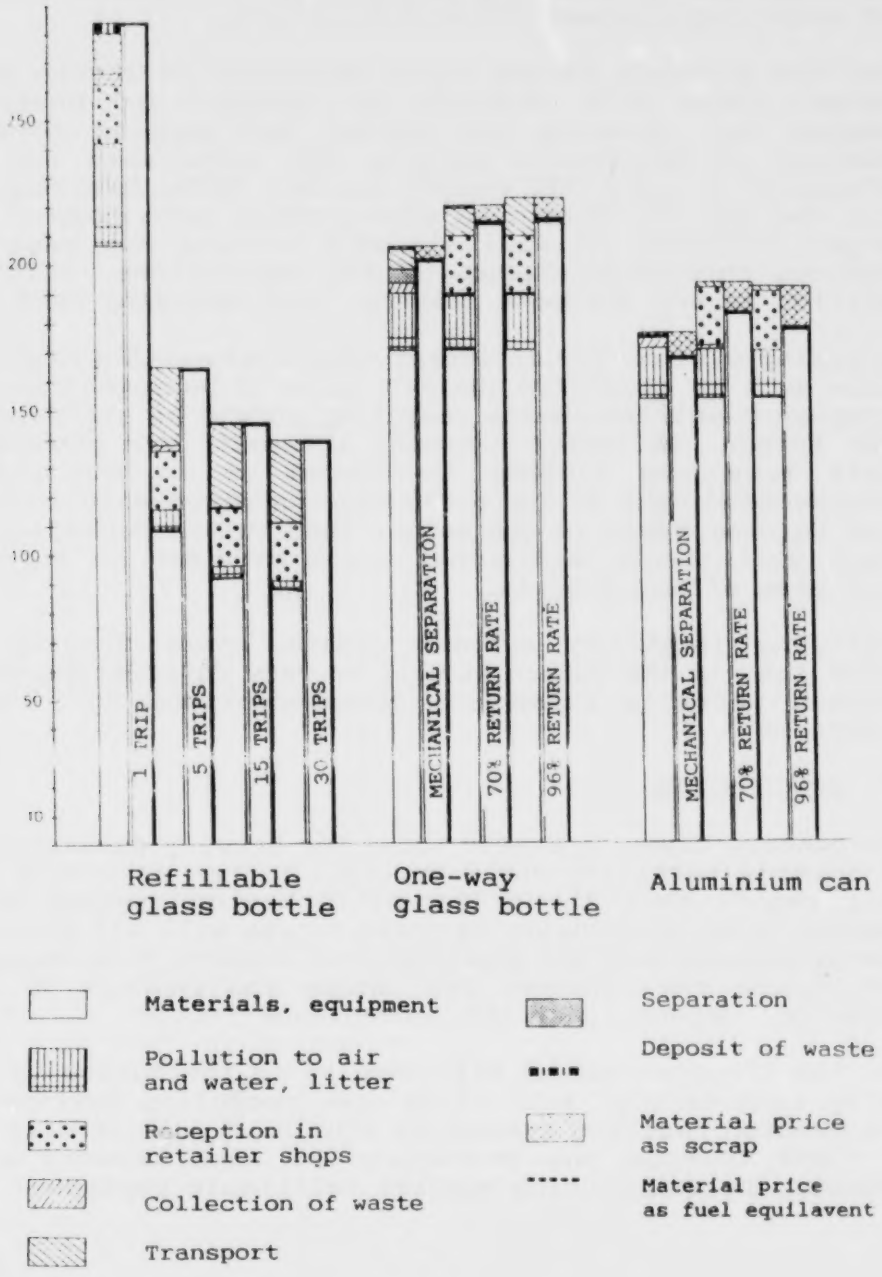
Fig. 19

Development of the Swedish market

Year	1983	1984	1985	1986	1987	1988	1989	1990
Beer and soft drinks sold in Sweden (million liter)	689	696	753	817	855	936	1010	1047
Cans sold (million)	600	607	645	698	734	772	830	843
Return rate (%)	0	63	66	65	75	80	82	83
Can share of the beer market %	54	55	55	56	57	59	60	60

The Board for Technical Development carried out a study in National 1979 of the cost of different packaging systems. The results are presented in Figure 20.

Fig. 20 Cost of beer and soft drink packaging



10. POLITICAL ASPECTS OF PACKAGING SYSTEMS

The Government of a country can protect its brewing industry by introducing special refillble systems and banning one-way and/or recycling systems. At the moment there is a trend towards introducing advanced refillable systems. Denmark has banned cans, but exports of cans to Germany and Sweden. Norway and Finland have very high taxes on one-way packages, and both countries are considering introducing refillable PET bottles and recycling systems for aluminium cans.

When the European market makes decisions on future packaging system, there will probably be economic and environmental reasons for choosing one system and banning others. The question of ecological balance for returnable and one-way bottles in a joint EEC market without trade barriers arises. Will the one-way bottle be ecologically more compatible with larger distances or will standard bottles and cases be introduced throughout Europe by EEC regulations, which can be refilled in any European brewery, this avoiding dead freight?

Recycling systems for different containers with a high material value such as aluminium and PET, have to be established in all European countries. Waste recycling should be standardized all over Europe. Different national interests and procedures for waste recycling already introduced or in the process of introduction have so far prevented concerted solutions throughout Europe. There is the danger that future packaging limitations will create additional trade barriers in Europe which will also affect exports.

Employing recycling systems creates open trading between countries. In the future it will be very interesting to see the Eurpean market's rules and recommendations for its member countries.

11. CONCLUSIONS

The general trend in Sweden today for brewery packaging systems is towards refilling and recycling. It has also been shown in this report that the different packaging systems which the Swedish brewing industry is going to use will all have the same energy consumption and environmental impact. This means that in the future the consumer can choose the package to suit the occasion, depending on the convenience factor.

How the European market will develop in the future is particularly interesting. Will it be open recycling systems such as the Swedish recyling system for aluminium cans or will there be a trend towards the protection of each country's brewing industry by introducing special refillable packages?